## CLAIMS

1. A network forwarding device connecting a plurality of networks comprising:

a port to which one of said networks is connected (  $(1)^3$ )

a network interface connected to said port and controlling an interface with the network connected to said port; and

a routing processor connected to said network interface via an intra-device communication line and performing routing of a packet received from said network interface;

wherein said routing processor includes:
path information holding means; and
next-path searching means for calculating,

based on path information held in said path information holding means, a path to which the received packet is to be forwarded next and

wherein, in a 2-branch tree search in which a destination address of the received packet is checked, one bit at a time beginning at a highest-order bit, said next-path searching means combines p (p is an integer equal to or larger than 2) levels into one 2<sup>p</sup>-branch tree to perform a search of the p levels of the 2-branch tree as a one-level search.

2. The network forwarding device according to claim 1 wherein said next-path searching means combines a total of  $(2^p - 1)$  2-branch tree nodes, composed of one

2-branch tree node and immediately lower 2-branch tree nodes of (p-1) levels, into one said  $2^p$ -tree node and, into the combined lowest-level  $2^{(p-1)}$  2-branch tree nodes, embeds path data allocated to higher-level nodes to form said  $2^p$ -tree node with  $2^{(p-1)}$  2-branch tree nodes.

- 3. The network forwarding device according to claim 2 wherein, when combining a plurality of 2-branch trees, said next-path searching means has only one element if the element may be shared.
- 4. The network forwarding device according to claim 2 wherein said next-path searching means does not read a whole node when reading the  $2^p$ -branch tree node but reads only data corresponding to one of the  $2^{(p-1)}$  2-branch tree nodes combined when the  $2^p$ -tree node was created.
- 5. The network forwarding device according to claim 2 wherein said next-path searching means stores into each node, not a mask length of the node, but a mask length of a node immediately below the node, to find the node mask length before reading data of the node and selects a part of the node data to be read according to a value stored in a bit position, indicated by the node mask length, to the bit position + p-1.
- 6. The network forwarding device according to claim 4 wherein said next-path searching device provides a flag in data that is read first for each node, said flag indicating whether or not a path is

allocated to the node, reads the flag first, and does not read path information for a node to which the path is not allocated.

- 7. The network forwarding device according to claim 1 wherein said network forwarding device is a router.
- 8. A network forwarding device connecting a plurality of networks comprising:
- a port to which one of said networks is connected;
- a network interface connected to said port and controlling an interface with the network connected to said port; and
- a routing processor connected to said network interface via an intra-device communication line and performing routing of a packet received from said network interface;

wherein said routing processor includes:

path information holding means; and

next-path searching means for calculating,

based on path information held in said path information

holding means, a path to which the received packet is

to be forwarded next

wherein said next-path searching means searches for a next path using a 2-branch tree search in which a destination address is checked, one bit at a time, beginning with a highest-order bit, performs a search for a match of an address and a mask by

associating a bit position to be checked with a mask length, expands 2<sup>m</sup> m-bit (m is a natural number) mask nodes into fixed positions in storing means, makes each of the m-bit mask nodes correspond, one to one, with a value that may be represented by bit 0 to bit (m-1) of the destination address, and selects one of the m-bit mask nodes according to a value represented by bit 0 to bit (m-1) of the destination address.

- 9. A network forwarding device connecting a plurality of networks comprising:
- a port to which one of said networks is connected;
- a network interface connected to said port and controlling an interface with the network connected to said port; and
- a routing processor connected to said network interface via an intra-device communication line and performing routing of a packet received from said network interface;

wherein said routing processor includes:

path information holding means; and

next-path searching means for calculating,

based on path information held in said path information holding means, a path to which the received packet is to be forwarded next

wherein said next-path searching means searches for a next path using a 2-branch tree search in which a destination address is checked, one bit at a

time, beginning with a highest-order bit, stores 0- to k-bit mask 2-branch tree nodes in internal storing means of said next-path searching means, a number of bits of each of said nodes being equal to or smaller than a predetermined number, stores (k+1)bit or longer mask 2-branch tree nodes in external storing means of said search means, and performs pipeline processing for 0- to k-bit mask node search processing and (k+1)bit or longer mask node search processing.

10. A network next-hop search method for use in a network forwarding device connected to a plurality of network and transmitting a packet received from one of said networks to a next hop based on path information

wherein, in a 2-branch tree search in which a destination address of the received packet is checked, one bit at a time beginning at a highest-order bit, p (p is an integer equal to or larger than 2) levels are combined into one 2<sup>p</sup>-branch tree to perform a search of the p levels of the 2-branch tree as a one-level search.

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